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Ship's emergency event monitoring systems

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DAB
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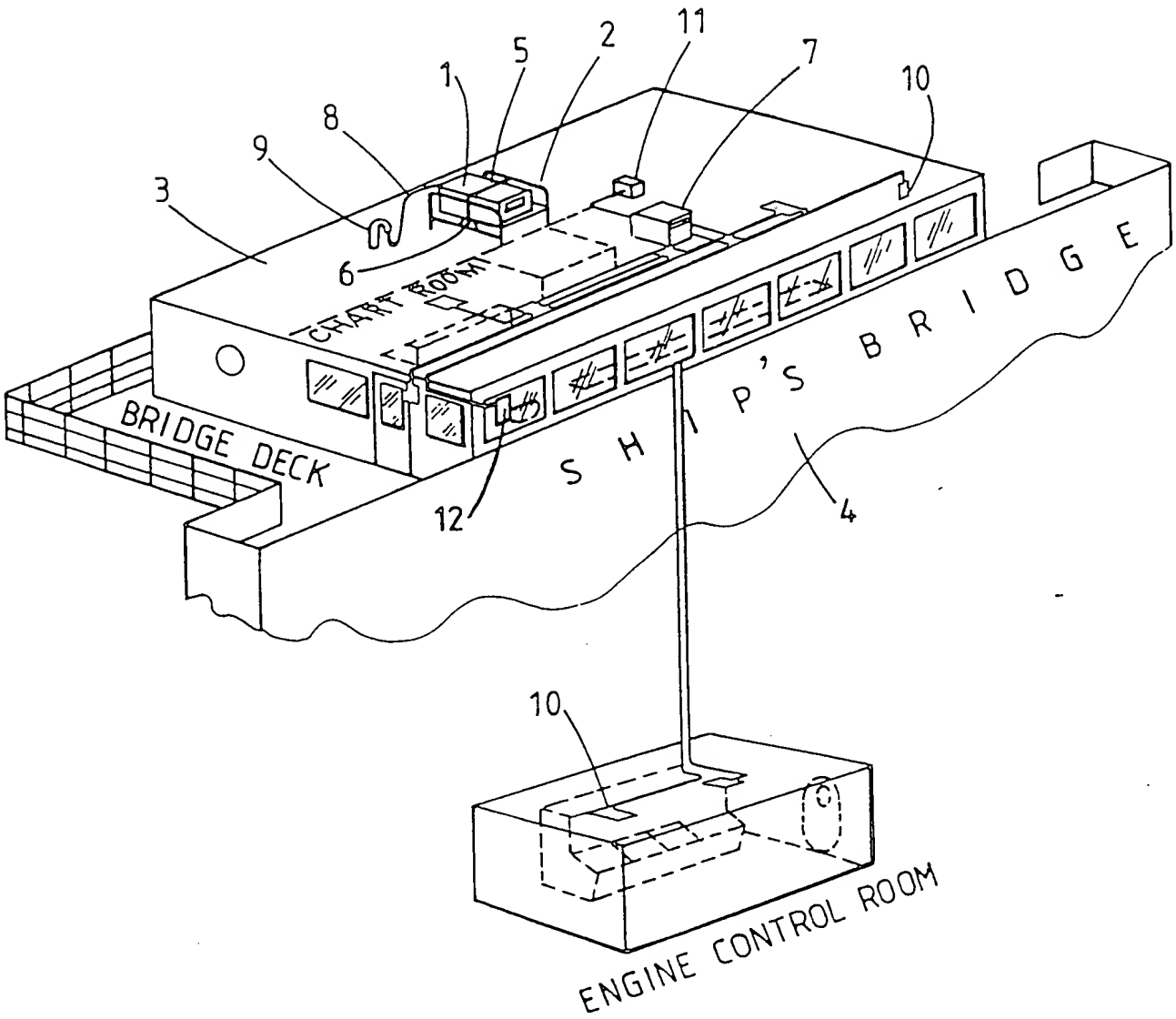
1
5
2
11
7
10
8
9
3
6
CHART ROOM
BRIDGE DECK
SHIP'S BRIDGE
12
4
10
ENGINE CONTROL ROOM

FIG. 1.

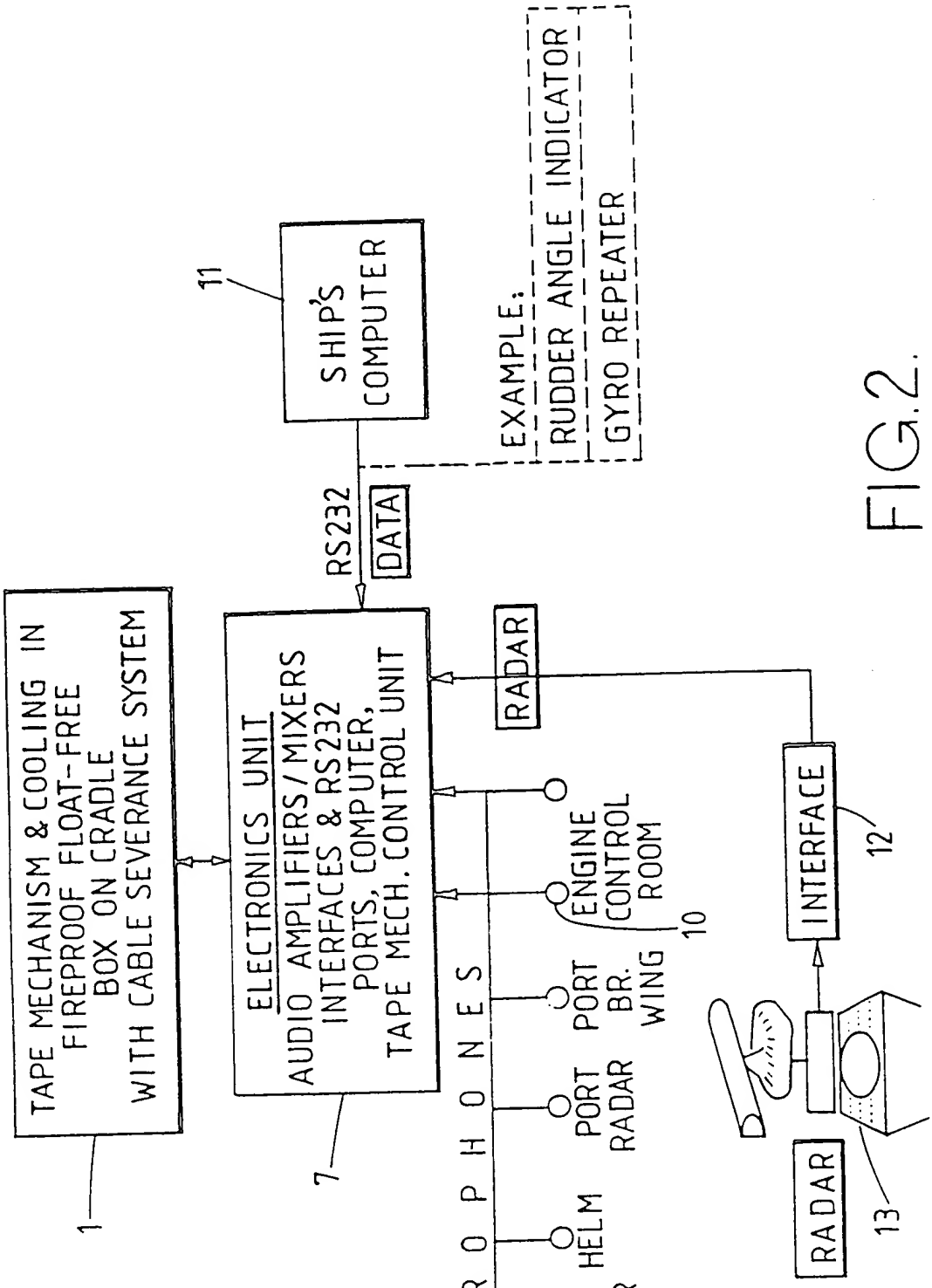
TAPE MECHANISM & COOLING IN FIREPROOF FLOAT-FREE BOX ON CRADLE WITH CABLE SEVERANCE SYSTEM
1
ELECTRONICS UNIT
AUDIO AMPLIFIERS/MIXERS INTERFACES & RS232 PORTS, COMPUTER, TAPE MECH. CONTROL UNIT
7
RS232
DATA
11
SHIP'S COMPUTER
EXAMPLE:
RUDDER ANGLE INDICATOR
GYRO REPEATER
RADAR
INTERFACE
12
RADAR
13
AUDIO
8 MICROPHONES
STBD. BR. WING
CHART TABLE
STBD. RADAR
HELM
PORT RADAR
PORT BR. WING
ENGINE CONTROL ROOM
10

FIG.2.

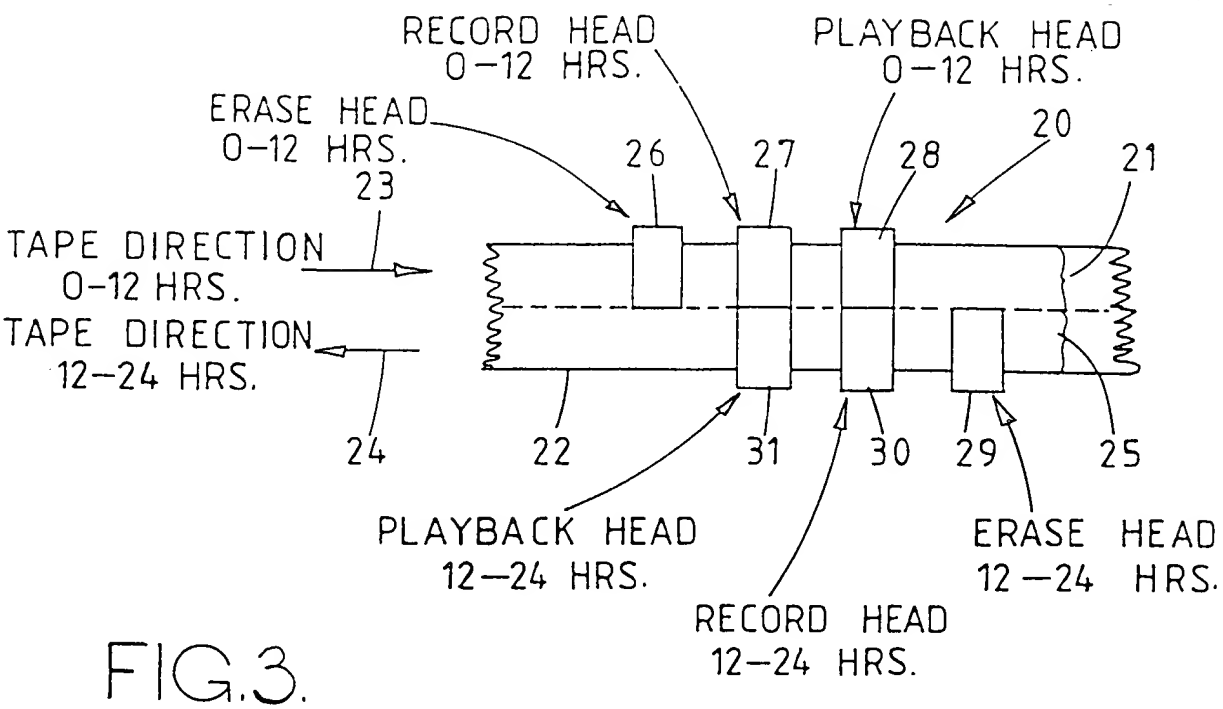
RECORD HEAD
0–12 HRS.
PLAYBACK HEAD
0–12 HRS.
ERASE HEAD
0–12 HRS.
23
20
26
27
28
21
TAPE DIRECTION
0–12 HRS.
TAPE DIRECTION
12–24 HRS.
24
22
31
30
29
25
PLAYBACK HEAD
12–24 HRS.
ERASE HEAD
12–24 HRS.
RECORD HEAD
12–24 HRS.

FIG.3.

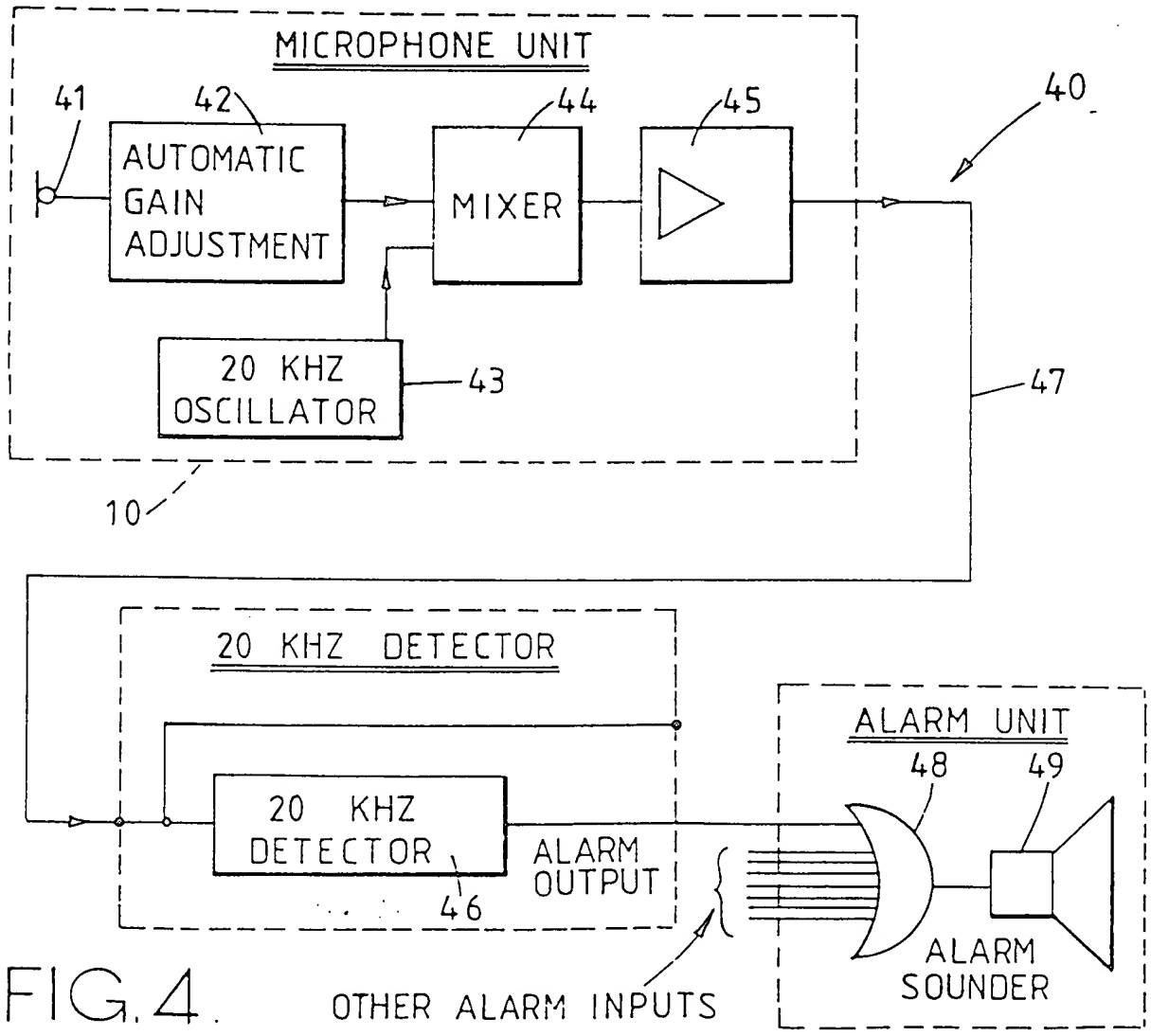
MICROPHONE UNIT
41
42
44
45
40
AUTOMATIC
GAIN
ADJUSTMENT
MIXER
20 KHZ
OSCILLATOR
43
47
10
20 KHZ DETECTOR
20 KHZ
DETECTOR
46
ALARM
OUTPUT
ALARM UNIT
48
49
ALARM
SOUNDER
OTHER ALARM INPUTS

FIG.4.

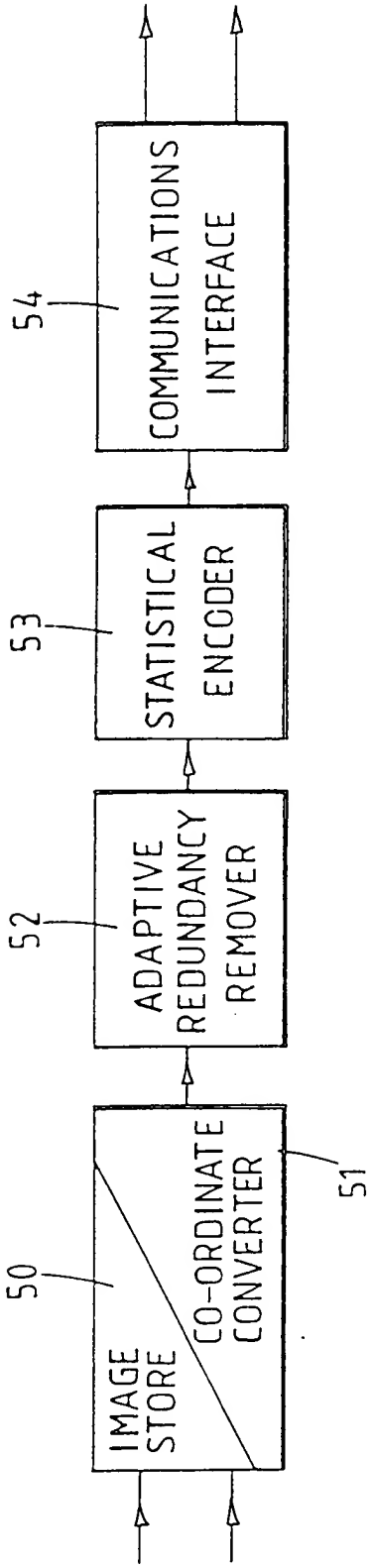
50
IMAGE STORE
CO-ORDINATE CONVERTER
51
52
ADAPTIVE REDUNDANCY REMOVER
53
STATISTICAL ENCODER
54
COMMUNICATIONS INTERFACE

FIG.5.

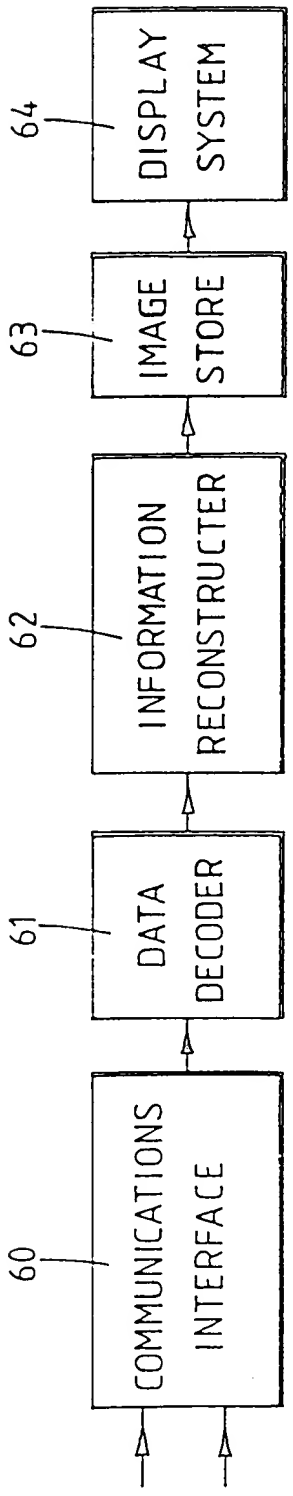
60
COMMUNICATIONS INTERFACE
61
DATA DECODER
62
INFORMATION RECONSTRUCTER
63
IMAGE STORE
64
DISPLAY SYSTEM

FIG.6.

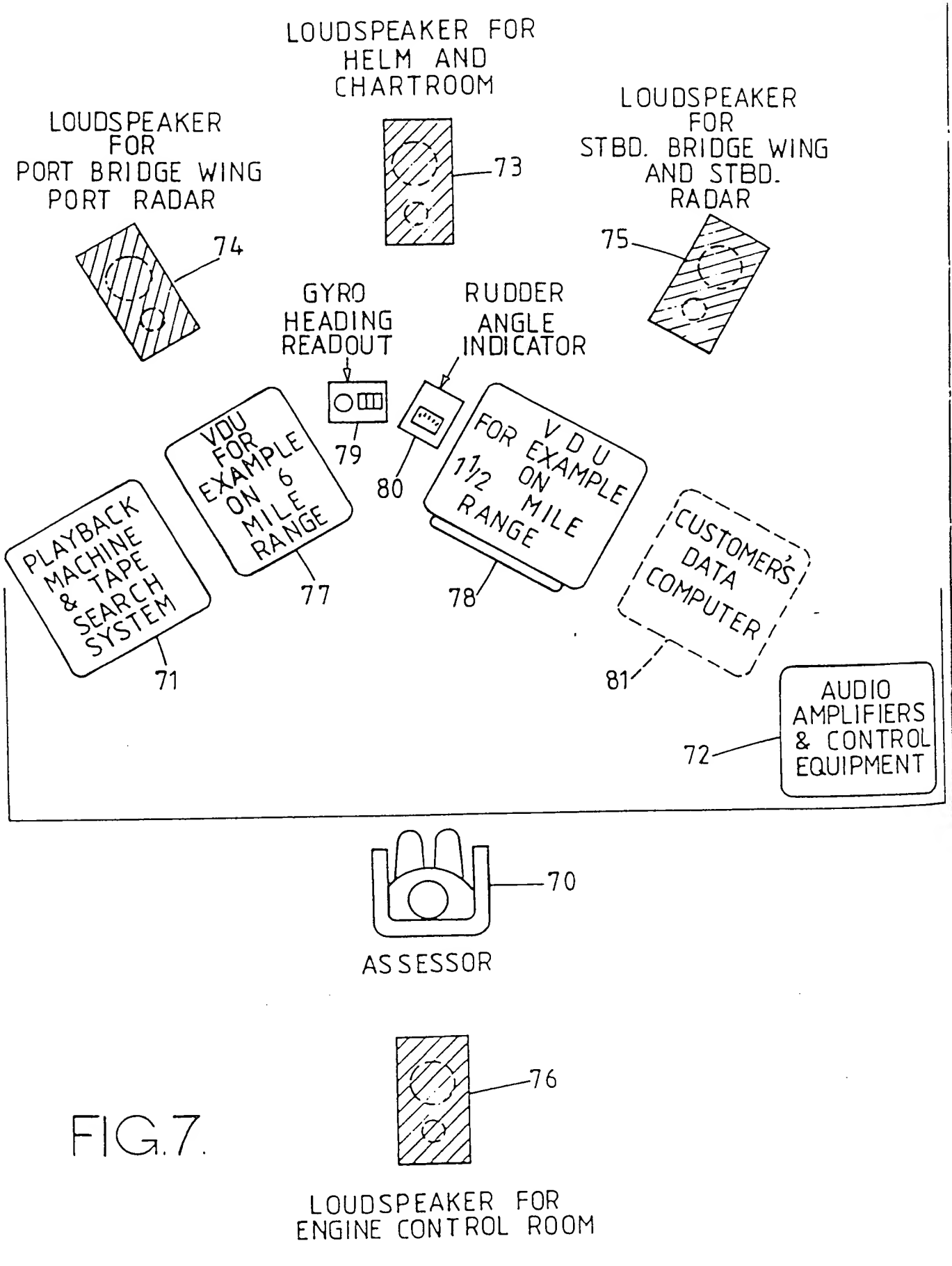
LOUDSPEAKER FOR HELM AND CHARTROOM
73
LOUDSPEAKER FOR PORT BRIDGE WING PORT RADAR
74
LOUDSPEAKER FOR STBD. BRIDGE WING AND STBD. RADAR
75
GYRO HEADING READOUT
79
RUDDER ANGLE INDICATOR
80
VDU FOR EXAMPLE ON 6 MILE RANGE
77
VDU FOR EXAMPLE ON 1½ MILE RANGE
78
PLAYBACK MACHINE & TAPE SEARCH SYSTEM
71
CUSTOMER'S DATA COMPUTER
81
AUDIO AMPLIFIERS & CONTROL EQUIPMENT
72
70
ASSESSOR
76
LOUDSPEAKER FOR ENGINE CONTROL ROOM

FIG.7.

"Ship's Emergency Event Monitoring Systems"

This invention relates to ship's emergency event monitoring systems for recording electrical signals generated on board ship in an emergency, and playback systems for retrieving the recorded electrical signals and providing an emergency event simulation for subsequent analysis.

Following several recent serious losses of ships at sea, increasing interest has been shown in the marine field in the provision of standard equipment mounted on board ship for monitoring onboard events in an emergency. Particularly in cases where the emergency leads to sinking of the ship, the equipment may provide valuable evidence which can subsequently be analysed to determine the cause of the emergency. It is important that the record of events made by the monitoring equipment should be readily analysable by persons who are skilled in the marine field but who are not necessarily skilled in the analysis of encoded data.

It is an object of the invention to provide a ship's emergency event monitoring system capable of providing a record of an emergency event which can subsequently be analysed.

According to the present invention there is provided a ship's emergency event monitoring system for recording electrical signals generated on board ship in an emergency, the unit providing interface means for receiving input signals from onboard radar means,

output means for supplying output signals in dependence on the input signals for recording by electrical recording means, and recording control means for controlling recording such that the output signals from the output means are continuously recorded in real time with respect to the signals generated on board ship and such that previously recorded signals are overwritten by newly recorded signals after a predetermined interval of time so that the recording means maintains a continuously updated record of the output signals supplied over the preceding predetermined interval of time.

After an emergency has occurred the recorded information may be played back over a playback system so as to provide as exact a simulation as possible over real time of the emergency event which can be readily analysed by persons skilled in the marine field.

Preferably the interface means includes data compression means for supplying compressed data input signals to the output means representative of information supplied by the onboard radar means. The data compression means may include redundancy removing means for removing redundant information from the information supplied by the onboard radar means to provide a data output, and statistical encoding means for statistically weighting the data output from the redundancy removing means according to an appropriate weighting rule. Such an arrangement enables data representative of radar information to be recorded in such a way that the radar information can be

enables data representative of radar information to be recorded in such a way that the radar information can be subsequently retrieved and such that the storage space for recording is decreased.

Advantageously the system also includes first recording check means for supplying a test signal to the recording means and for monitoring the recorded test signal to check that the recording means is operating correctly.

Furthermore the system may also include second recording check means for supplying a test signal to the or each onboard microphone unit and for monitoring the test signal received by the interface means to check that the microphone unit is operating correctly.

The unit may also include alarm means for providing an audible warning in the event that the first and/or second recording check means indicates the occurrence of a fault.

Such a system may incorporate a casing adapted to be mounted on the deck of the ship and releasable therefrom in response to predetermined emergency conditions, such as in response to immersion in water, and electrical recording equipment within the casing adapted to maintain a continuously updated record of electrical signals generated on board ship over the preceding predetermined interval of time.

Preferably the electrical recording equipment is a tape recorder provided with the recording control means.

Furthermore the tape recorder may be adapted to record signals along a first track or first series of tracks on a tape while the tape is running in one

direction in a first period of time, and to record signals along a second track or second series of tracks on the tape while the tape is running in the opposite direction in a second period of time immediately following the first period of time.

Advantageously the tape recorder has a first recording head for recording signals along the first track or first series of tracks and a second recording head for recording signals along the second track or second series of tracks, and preferably also a first erase head for erasing signals previously recorded along the first track or first series of tracks and a second erase head for erasing signals previously recorded along the second track or second series of tracks.

The invention also provides a playback system for retrieving electrical signals recorded by the ship's emergency event monitoring system and for providing an emergency event simulation by means of appropriate transducers, such as loudspeakers and display means.

In order that the invention may be more fully understood, a preferred embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram of the system on board ship;

Figure 2 is a block diagram of the system;

Figure 3 is a schematic diagram illustrating the arrangement of the tape heads;

Figure 4 is a block diagram of microphone check circuitry;

Figures 5 and 6 are block diagrams of a radar data compression unit and a complementary playback unit; and

Figure 7 is a schematic diagram of a playback system.

Referring to Figure 1, a cassette tape recorder within a heat-proof and water-proof casing 1 is releasably connected to a cradle 2 which is mounted on top of the wheelhouse 3 on the bridge 4 of a ship. The casing 1 is normally held within the cradle 2 by a webbing band 5 secured by a hydrostatic release mechanism 6 of a per se known type which is released in response to immersion in water. The tape recorder within the casing 1 is connected to a below decks control unit 7 by means of a cable 8 extending through a gooseneck 9.

In the event of the ship sinking, the hydrostatic release mechanism 6 is operated in response to immersion in water to sever the attachment of the webbing band 5 at one end and to permit the casing 1 containing the tape recorder to float free of the ship's bridge 4. The connection of the lead 8 to the casing 1 may be disengaged by a similar hydrostatic release mechanism and/or by a heat-sensitive release mechanism. Although not shown in the drawings, the casing 1 may also be provided with an underwater locater beacon (UWL), an emergency position indicating radio beacon (EPIRB) and a

cooling system for removal of heat generated within the casing 1 by operation of the tape recorder.

As is shown schematically in Figure 2, the control unit 7 is connected to receive input signals from eight microphone units 10, from the ship's computer 11 and from a radar interface 12 connected to the ship's radar equipment 13. The microphone units 10 are variously located on the ship to provide optimum monitoring of sound, particularly voices of the ship's crew, in an emergency event, and preferably include microphone units mounted in the port and starboard bridge wings, in the chart room, at the helm, in the vicinity of the port and starboard radar and in the engine control room. The ship's computer 11 supplies signals indicative of logged ship's data, obtained, for example, from ship's instruments such as the rudder angle indicator and the gyro repeater, to the control unit 7 by means of an RS232 port. Furthermore the control unit 7 receives compressed data representative of radar information displayed on the ship's radar equipment 13 which is subjected to data compression in the interface 12 to permit the data to be recorded in a normal audio bandwidth, rather than in a wide radar bandwidth, in a manner which will be described more fully below.

The control unit 7 includes interfaces for the input signals and audio amplifiers and mixers for producing from the input signals eight output signals to be recorded on eight tape recorder channels. Of these

eight channels, three may be provided for signals representative of audio information, three may be provided for signals representative of ship's data and two may be provided for signals representative of radar information. In addition the control unit 7 includes a tape recorder control section for controlling recording such that the output signals from the control unit 7 are continuously recorded with previously recorded signals being overridden by newly recorded signals after a 24 hour interval of time so that the tape recorder maintains a continuously updated record of the output signals supplied over the preceding 24 hour interval of time.

Furthermore the tape recorder has a tape head arrangement 20, as schematically shown in Figure 3, which is adapted to record the output signals along a first series of eight tracks 21 while the tape 22 is running in the direction shown by the arrow 23 in a first 12 hour period, and to record the output signals along a second series of eight tracks 24 while the tape 22 is running in the direction shown by the arrow 25 in a second 12 hour period immediately following the first 12 hour period. The tape mechanism is controlled so that the tape runs in the direction 23 until the end of the tape is reached when the tape mechanism is reversed to cause the tape to run in the direction 24 again until the end of the tape is reached at which time the tape mechanism is again reversed. Thus the direction of tape travel will be reversed every 12 hours and a continuously updated record

of signals received over the preceding 24 hours will be maintained. In this regard the tape head arrangement 20 comprises an erase head 26, a record head 27 and a playback head 28 associated with the first series of tracks 21, and an erase head 29, a record head 30 and a playback head 31 associated with the second series of tracks 25. It will be appreciated that signals recorded 24 hours previously will be erased by the erase head 26 or 29 prior to the recording of fresh signals by the record head 27 or 30, the playback head 28 or 31 providing playback of the signals just recorded for monitoring purposes as will be described below.

Figure 4 shows a block diagram of a security/protection arrangement for checking that input signals are being correctly received by the control unit 7 from each microphone unit 10. In this regard each microphone unit 10 comprises a microphone 41, an automatic gain adjustment circuit 42, a 20kHz oscillator 43 for generating a test signal, a mixer 44 and an amplifier 45. Furthermore the associated interface of the control unit 7 includes a 20kHz detector 46 for monitoring the test signal generated by the oscillator 43. If the detector 46 fails to detect the test signal, this indicates either that the power supply to the associated microphone unit has failed or that the interunit cable 47 has been damaged or disconnected. In the case of the detector 46 associated with any of the microphone units 10 failing to detect the test signal, an alarm signal is supplied by way

of a common gate 48 to sound an alarm sounder 49.

Although not specifically shown in the drawings, a broadly similar arrangement is provided for supplying a sub-audible test signal to the appropriate record head of the tape recorder together with the other output signals from the control unit 7 and for detecting the presence of the test signal in the signals fed back by the associated playback head. Again, in the event that the test signal is not detected, this indicates the occurrence of a fault, for example that the tape recorder is not operating, and an alarm signal is then supplied to an alarm sounder.

As previously indicated the radar information is subjected to data compression prior to recordal, and the system of data compression will now be described with reference to Figure 5 which illustrates the conversion of the raster scan information of an image on the radar equipment to data for recordal by the tape recorder, as well as with reference to Figure 6 which illustrates the conversion of the recorded data to information for display on a playback display simulating the original radar image.

Referring to Figure 5, the raster scan information from the radar equipment, expressed in polar coordinates, is supplied by way of video and trigger inputs to an image store 50. The stored information is converted to cartesian coordinates in a coordinate converter 51. The radar information expressed in cartesian coordinates is then supplied to an adaptive

redundancy remover 52 which analyses the relationships between the signal levels of each pixel in each line of the stored image and which removes redundant information on the basis of the relationships found. The redundancy remover 52 then supplies data representative of image information to a statistical encoder 53 which applies an appropriate weighting rule to the data supplied so as to provide appropriate data for recordal which is supplied by means of a communications interface 54 which applies data and clock outputs to the tape recorder. This data compression system is broadly described in the article by W. J. Mullarkey and R. C. Chivers "Using an Inaccurate Model for Efficient Communication of a Sonar Image" in the Proceedings of the Institute of Acoustics, Vol.11, Part 8, 1989, Pages 198-205. Typically this enables radar information of 655K bits to be represented by recorded data of 25K to 50K bits.

The complementary system of Figure 6 for playing back the recorded radar data comprises a communications interface 60 for receiving data and clock signals from the tape recorder and for supplying a data signal for decoding in a data decoder 61. The radar information is then reconstructed from the decoded data in an information reconstructor 62 and is stored in an image store 63 for display by a display system 64 either in the original format of the ship's radar equipment or in some other format.

The recording produced of an emergency event in

the manner described above may be played back after retrieval by a system as schematically shown in Figure 7 in order to provide as exact a simulation as possible of the conditions on the ship's bridge and in the engine control room during the emergency event. To this end the system includes the following equipment suitably placed in relation to an assessor 70:

1. A playback machine 71, including a tape search system, for playing back the retrieved tape,

2. Associated audio amplifiers and control equipment 72,

3. Loudspeakers 73, 74, 75 and 76 for playing back the sound recorded respectively at the helm and in the chart room, at the port bridge wing and port radar, at the starboard bridge wing and starboard radar, and in the engine control room,

4. Display units 77 and 78 for displaying radar information, for example at six mile range and one and half mile range respectively,

5. A gyro heading readout 79 and a rudder angle indicator 80 for indicating data from the ship's computer, and

6. Optionally a computer terminal 81 permitting input of further data to the playback system.

2242330

Key Features

CLAIMS

1. A ship's emergency event monitoring system for recording electrical signals generated on board ship in an emergency, the system comprising interface means for receiving input signals from onboard radar means, output means for supplying output signals in dependence on the input signals for recording by electrical recording means, and recording control means for controlling recording such that the output signals from the output means are continuously recorded in real time with respect to the signals generated on board ship and such that previously recorded signals are overwritten by newly recorded signals after a predetermined interval of time so that the recording means maintains a continuously updated record of the output signals supplied over the preceding predetermined interval of time.

2. A system according to claim 1, wherein the interface means includes data compression means for supplying compressed data input signals to the output means representative of information supplied by the onboard radar means.

3. A system according to claim 2, wherein the data compression means includes redundancy removing means for removing redundant information from the information supplied by the onboard radar means to provide a data output, and statistical encoding means for statistically

weighting the data output from the redundancy removing

weighting the data output from the redundancy removing means according to an appropriate weighting rule.

4. A system according to claim 1, 2 or 3, which includes first recording check means for supplying a test signal to the recording means and for monitoring the recorded test signal to check that the recording means is operating correctly.

5. A system according to any preceding claim, which includes second recording check means for supplying a test signal to the or each onboard microphone unit and for monitoring the test signal received by the interface means to check that the microphone unit is operating correctly.

6. A system according to claim 4 or 5, which includes alarm means for providing an audible warning in the event that the first and/or second recording check means indicates the occurrence of a fault.

7. A system according to any preceding claim, which incorporates a casing adapted to be mounted on the deck of the ship and releasable therefrom in response to predetermined emergency conditions, and electrical recording equipment within the casing adapted to maintain a continuously updated record of electrical signals generated on board ship over the preceding predetermined interval of time.

8. A system according to claim 7, wherein the electrical recording equipment is a tape recorder provided with said recording control means.

9. A system according to claim 8, wherein the tape

recorder is adapted to record signals along a first track or first series of tracks on a tape while the tape is running in one direction in a first period of time, and to record signals along a second track or second series of tracks on the tape while the tape is running in the opposite direction in a second period of time immediately following the first period of time.

10. A system according to claim 9, wherein the tape recorder has a first recording head for recording signals along the first track or first series of tracks and a second recording head for recording signals along the second track or second series of tracks.

11. A system according to claim 9 or 10, wherein the tape recorder has a first erase head for erasing signals previously recorded along the first track or first series of tracks and a second erase head for erasing signals previously recorded along the second track or second series of tracks.

12. A system according to any preceding claim, wherein the interface means is adapted to receive input signals from onboard microphone units and/or onboard ship's data logging means.

13. A ship's emergency event monitoring system substantially as hereinbefore described with reference to the accompanying drawings.